

Claims

- [c1] 1.A steam generation apparatus comprising:
a steam injection boiler including a burner operable therein;
a fired heater including a heater burner;
a water tube circuit extending through the fired heater and the steam injection boiler, the tube selected to convey water in order to heat the water to generate steam;
a fuel tube extending through fired heater selected to convey liquid fuel in order to generate heated liquid fuel;
and
a tube for conveying the heated liquid fuel to support the firing of the steam injection boiler.
- [c2] 2.The steam generation apparatus of claim 1 wherein the water tube circuit passes first through the fired heater and then through the steam injection boiler.
- [c3] 3.The steam generation apparatus of claim 1, the heater further including a convection zone and a radiant zone and wherein the water tube circuit passes through the fired heater convection zone and the fired heater radiant zone.

- [c4] 4.The steam generation apparatus of claim 1, the steam injection boiler further including a convection zone and a radiant zone and wherein the water tube circuit passes, in series, through the boiler convection zone, the fired heater and the boiler radiant zone.
- [c5] 5.The steam generation apparatus of claim 1 wherein the heater burner operates on gaseous fuel.
- [c6] 6.The steam generation apparatus of claim 1 wherein the heater burner is capable of operating on both gaseous fuel and liquid fuel.
- [c7] 7.The steam generation apparatus of claim 6 further comprising a tube for conveying the heated liquid fuel to support the firing of the fired heater.
- [c8] 8.The steam generation apparatus of claim 1 the fired heater further including a convection zone and wherein the fuel tube passes through the fired heater convection zone in order to generate heated liquid fuel.
- [c9] 9.The steam generation apparatus of claim 8, wherein the water tube circuit passes through the fired heater convection zone and the fuel tube is shielded by the water tube circuit to reduce coking in fuel tube.
- [c10] 10.The steam generation apparatus of claim 1, the steam

injection boiler further including an exhaust stack and a scrubber operationally mounted in the exhaust stack.

[c11] 11.The steam generation apparatus of claim 1 wherein the heater burner is capable of operating on liquid fuel and the fired heater being in communication with an exhaust stack including a scrubber operationally mounted therein.

[c12] 12.The steam generation apparatus of claim 1 further comprising ducting between the fired heater and the steam injection boiler, an exhaust stack and a scrubber operationally mounted in the exhaust stack and wherein the flue gases generated by both the heater and the steam injection boiler are passed through the exhaust stack.

[c13] 13.The steam generation apparatus of claim 1 wherein the firing rate of the heater burner can be adjusted to adjust steam quality and/or quantity generated by the steam generation apparatus.

[c14] 14.A steam injection boiler conversion unit for converting a steam injection boiler from gaseous fuel firing to be capable of liquid fuel firing, the steam injection boiler including a burner operable therein and a boiler tube extending therethrough, the steam injection boiler conver-

sion unit comprising:

a fired heater including a heater burner;

a water tube extending through the heater, the water tube selected to convey water in order to heat the water and the water tube being connectable into fluid flow communication with the boiler tube such that, when connected, fluid passing from the water tube can pass into the boiler tube;

a fuel tube extending through the heater, the fuel tube selected to convey liquid fuel in order to generate heated liquid fuel; and,

a line connectable into fluid flow communication with the burner of the boiler for supplying the heated liquid fuel to support the firing of the boiler burner, when the conduit is connected to the boiler burner.

[c15] 15.The steam injection boiler conversion unit of claim 14, wherein the fired heater is operable to heat the liquid fuel to a temperature suitable for firing the boiler burner.

[c16] 16.The steam injection boiler conversion unit of claim 14, wherein the fired heater is operable to preheat the water and delivers it to the inlet of the steam injection boiler at a temperature that offsets the shortfall in heat liberation from a liquid fuel flame suitable for generation within the steam injection boiler.

- [c17] 17. The steam injection boiler conversion unit of claim 14, the heater further including a convection zone and a radiant zone and wherein the water tube passes through the fired heater convection zone and the fired heater radiant zone.
- [c18] 18. The steam injection boiler conversion unit of claim 14, the steam injection boiler further including a convection zone and a radiant zone and wherein the water tube receives water having already passed through the boiler convection zone.
- [c19] 19. The steam injection boiler conversion unit of claim 14 wherein the heater burner operates on gaseous fuel.
- [c20] 20. The steam injection boiler conversion unit of claim 14 wherein the heater burner is capable of operating on both gaseous fuel and liquid fuel.
- [c21] 21. The steam injection boiler conversion unit of claim 20 further comprising a tube for conveying the heated liquid fuel to support the firing of the fired heater.
- [c22] 22. The steam injection boiler conversion unit of claim 14 the fired heater further including a convection zone and wherein the fuel tube passes through the fired heater convection zone in order to generate heated liquid fuel.

- [c23] 23. The steam injection boiler conversion unit of claim 22, wherein the water tube circuit passes through the fired heater convection zone and the fuel tube is shielded by the water tube to reduce coking in the fuel tube.
- [c24] 24. The steam injection boiler conversion unit of claim 14 wherein the heater burner is capable of operating on liquid fuel and the fired heater being in communication with an exhaust stack including a scrubber operationally mounted therein.
- [c25] 25. The steam injection boiler conversion unit of claim 24 further including a duct connectable to the boiler for passing flue gases to the steam injection boiler.
- [c26] 26. A method for converting a steam injection boiler from gaseous fuel firing to be capable of liquid fuel firing, the steam injection boiler including a burner operable therein and a boiler tube extending therethrough, the method for converting comprising:
providing a fired heater including a heater burner, a water tube extending through the heater, the water tube selected to convey water in order to heat the water and a fuel tube extending through the heater, the fuel tube selected to convey liquid fuel in order to generate heated liquid fuel;

bringing the water tube in fluid flow communication with the boiler tube such that fluid passing from the water tube can pass into the boiler tube; and conveying the heated liquid fuel to the burner of the boiler to support the firing of the steam injection boiler.

[c27] 27. The method of claim 26 further comprising replacing the burner of the steam injection boiler with a burner compatible with liquid fuel burning.

[c28] 28. The method of claim 26, further comprising modifying the steam injection boiler to handle at least some of the emissions from liquid fuel combustion.

[c29] 29. The method of claim 26, the steam injection boiler further including an exhaust stack and the method further comprising, installing in the exhaust stack a scrubber for handling at least some of the emissions from liquid fuel combustion.

[c30] 30. The method of claim 26, wherein the steam injection boiler can continue to be operated until the step of bringing the water tube into fluid communication with the boiler tube.

[c31] 31. A method for generating steam, the method comprising:
providing a steam generation apparatus including a

steam injection boiler having a burner operable therein; a fired heater including a heater burner; a water tube circuit extending through the fired heater and the steam injection boiler, the water tube circuit selected to convey water in order to heat the water to generate steam; a fuel tube extending through the heater selected to convey liquid fuel in order to generate heated liquid fuel; and a line for conveying the heated liquid fuel to support the firing of the steam injection boiler; firing the fired heater to heat a supply of liquid fuel passing through the fuel tube; conveying the liquid fuel through the conduit to support firing of the steam injection boiler; and passing a flow of water through the water tube circuit such that steam is generated.

[c32] 32. The method for generating steam of claim 31 wherein the liquid fuel is taken from in situ production.

[c33] 33. The method for generating steam for in situ production of petroleum products of claim 32 wherein the liquid fuel is used while it retains latent heat from production.

[c34] 34. The method for generating steam of claim 31 further comprising operating the fired heater on gaseous fuel initially and, thereafter, operating the fired heater with

heated liquid fuel.

[c35] 35. The method for generating steam of claim 31, the method further comprising adjusting steam quality generated by adjusting the firing rate of the fired heater.